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IRAS ASTEROID FAMILIES; G.J. Veeder, J.G. Williams, E.F. Tedesco and D.L. Matson, Jet Propulsion Laboratory, California Institute of Technology

The Infrared Astronomical Satellite (IRAS) sampled the entire asteroid population at wavelengths from 12 to 100 microns during its 1983 all sky survey. The IRAS Minor Planet Survey (IMPS) includes updated results for more recently numbered as well as other additional asteroids with reliable orbital elements. Albedos and diameters have been derived from the observed thermal emission and assumed absolute visual magnitudes and then entered into the IMPS database at the Infrared Processing and Analysis Center (IPAC) for members of the Themis, Eos, Koronis and Maria asteroid families and compared with their visual colors. The IMPS results for the small (down to about 20 km) asteroids within these major families confirm trends previously noted for their larger members. Each of these dynamical families which are defined by their similar proper elements appears to have homogeneous physical properties. For example, small members of the large Themis family are also dark. The Eos family has intermediate albedos and B-V colors between the ranges observed for main belt C and S class asteroids. In particular, the centroid of the range of albedos for the Eos family near a value of 0.1 is at a relative minimum for the albedo distribution observed for the general main belt asteroid population. The homogeneity observed within each major asteroid family implies that even if the two parent bodies of the S class asteroids in the Koronis and Maria families were differentiated they had relatively uniform interiors and did not have large distinct (metallic) cores.

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High Resolution Images of P/Tempel 1 and P/Tempel 2 Constructed from IRAS Survey Data

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Infrared images of P/Tempel 1 and P/Tempel 2 have been constructed from IRAS survey data using a computer algorithm based on the Maximum Correlation Method for Image Construction (MCM) (Aumann, H.H., Fowler, J.W., and Melnyk, M., Astron. J. **99**, no.5, pp 1674-1681, 1990). Image construction was performed in a moving Sun-referenced coordinate system with the comet at the origin. Motion of the comet relative to the IRAS scans determines the number of scans within the image, and thus limits the effective spatial resolution achievable by the MCM to about 40 arcsec at 12 μm and 25 μm, 57 arcsec at 60 μm, and 80 arcsec at 100 μm. The five sets of images of Tempel 1 at 12, 25, 60 and 100 μm span the period from 4.6 days to 81 days after perihelion passage. The four sets of images of P/Tempel 2 were taken from 46 to 97 days past perihelion. Figures 1 and 2 show a typical pair of 12 μm images of Tempel 1 and Tempel 2. Solar illumination is from the left. The heliocentric and geocentric distances are 1.50 AU and 1.08 AU respectively for both comets, and the phase is 42°. Tempel 1 is 19 days past perihelion, while Tempel 2 is 56 days past perihelion. The peak radiance of Tempel 1 is 126 MJy/sr, while that of Tempel 2 is 67 MJy/sr. Contours start at 3 times the mean noise of the map and are increasing by $\sqrt{2}$. The prominent linear feature in the Tempel 2 image is the dust trail which is observed both ahead and behind the comet along its orbit. Direct comparisons of post perihelion comet dust activity are made at comparable heliocentric distances, and the relative production of large grains is determined.

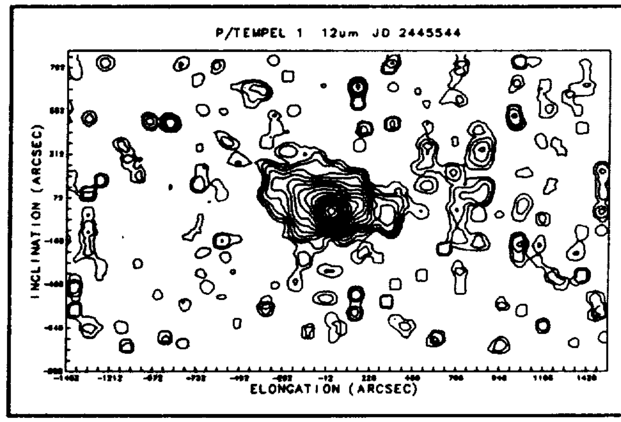

Figure 1. Image of Tempel 1 after 12 iterations of the MCM.

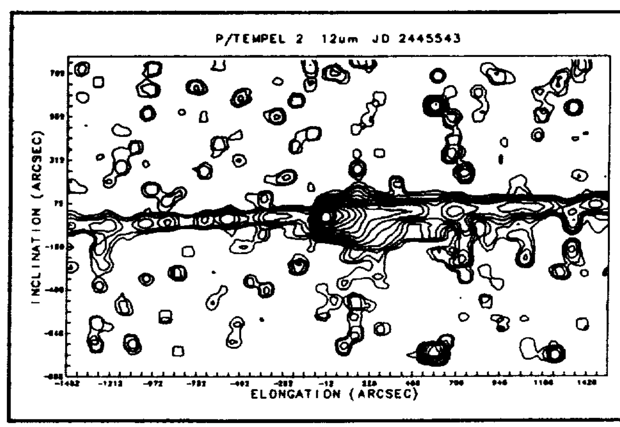

Figure 2. Image of Tempel 2 after 12 iterations of the MCM.

DISCOVERY OF COMETARY DUST FROM GRANITE Wang Erkang, Hu Zhong wei, Wan Yuqiu. Nanjing University, 210008, Nanjing China*

A large number of dark magnetic microspherules were extracted from granite near Suzhou, Jiangsu province, China. Most of them range in diameter from 0.1-0.3mm. They can be divided into three types: Iron, Stony and Glassy. The analyzed results prove that these spherules are of extraterrestrial origin (1) (2). Further studies show the microspherules are of cometary dust.

The main chemical compositions of the spherules(for example:SiO_2-45.39, TiO_2-0.95, Al_2O_3-32.32, FeO-7.07, MnO-0.02, MgO-1.98, CaO-4.49, Na_2O-0.25, K_2O-0.90) are similar to those of Tunguska spherules. Some dusts are mainly composed of Fe, C, Ni, with the maximum content of C up to 9.21%. As M.E Lawler et al(1989) found that about 1% of Halley's comet dust are almost completely composed of Fe and C, auther belives these two kinds of dusts are quite similar to each other. Under HREM, special microscrystals, such as whiskers and platelets, can be observed in some samples, which reveals the characteristic of gas to particle. The INAA results demonstrate that contents of Al, Ca, Ti, V, Sc,, Hf, W are enriched, while Mg, Mn, Co, Cr, Zn seriously depleted. Besides, Content of REE is much more than that of CI chondrite. The REE distribution partten displays that it has not been differentiated obviously. In contrast to the results of K. Notsu (1978), main element and trace element of some samples are very similar to that of vaporized residual fraction of Allende meteorite.

These general characteristics mentioned above indicate that: Being riched in pre-solar system component features these dusts, and is exactly similar to cometary dust known so far. That shows the dusts are cometary origin. They took part in the evolution of the Earth and were captured by granite magma during the Mesozoic era.

References:

(1) Wang Erkang, et al., 1990,15th IMA. abstracts, 670-671.
(2) Wang Erkang, et al., 1990, 126th IAU. abstracts, 124.

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ROTATION OF SPLIT COMETARY NUCLEI

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The rotational motion of split cometary nuclei is studied. A large-amplitude precession in each fragment is easily excited by the splitting. Some simulation cases show the excitation of higher energy state for rotation with given angular momentum. The rotational state strongly depends on the mass-volume partition of the nuclei at the splitting, and on the original rotation.

This characteristic of the cometary nuclei survived after the splitting gives us a clue to study the internal structure of the nuclei. The damping of the precession needs long time(>10 Myr) if the internal dissipation is similar to that of asteroid(Burns and Safronov 1973). Hence, if most of the nuclei which were remnants of splitting have no large precession, then the internal structure of the cometary nuclei would be extremely fragile.

The excitation of the precession also gives us an important information on the origin of the short period comets. It is proposed that the short period comets are supplied from the larger bodies of long period comets by splitting. This idea solves the unbalance problem of number flux between the short and long period comets. There may be evidences for supporting this idea, for example, many splitting events, sun-grazing comets, and Chiron. This idea can be tested by observing rotational state of the short period comets if the internal dissipation in the nuclei is small. If they have precession with large amplitude, then these comets may be split origin.

On these view points, it is important to observe the split nuclei. We also show the result of CCD imaging observation of comet P/Taylor, which is a survived nucleus of splitting in 1916.

METEOR RADIANT MAPPING WITH MU RADAR

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We carried out mapping of radiant point of the meteor shower with the MU radar located at Shigaraki, Japan(34.85° N, 136.10° E). This radar is characterized by an active phased array system, and mainly used for atmospheric observations. The frequency is 46.5 MHz, which is also appropriate for meteor echo observations. As same as other radar systems, the MU radar can be interferometric use for determining the position of the meteors.

Our mapping method is similar to that originally proposed by Morton and Jones(1982). The modification is that we weighted each meteor by using the beam pattern. We present some preliminary results of the radiant point mapping of several meteor shows.

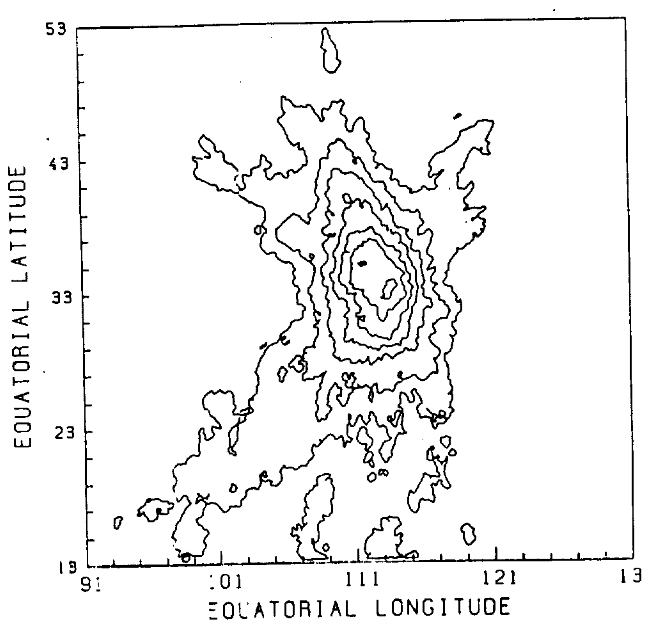

Fig. Radiant point map of the Geminids in 1989.

NEAR-IR IMAGING OBSERVATION OF COMET AUSTIN 1989C1

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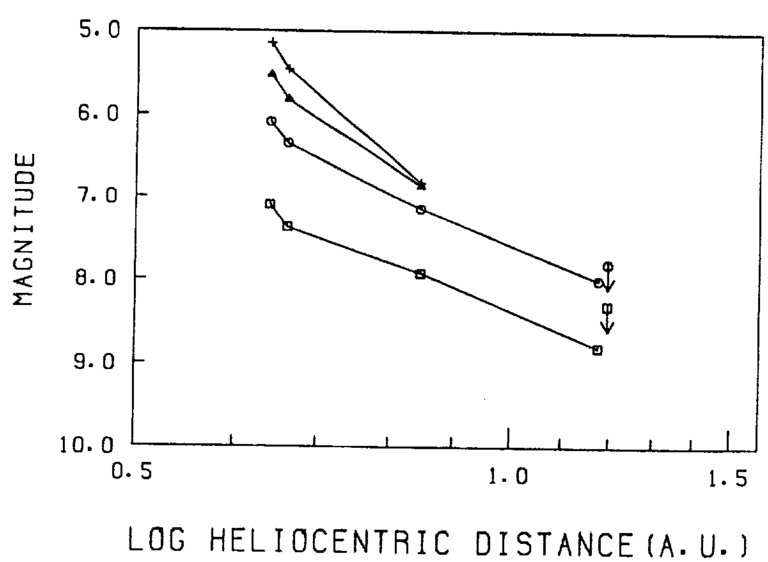
Imaging observations of comet Austin 1989c1 were carried out with an array detector attached to the Nasmyth focus of the 1.5-m telescope. We obtained 36 images of J, H, K bands in total on April 29, 30, May 9, 26, and 27. A featureless, round shape of the comet was revealed in all images of 4.2' field of view. The asymmetry of the coma was not recognized even if we applied an image enhancement technique. The intensity distribution is well fitted by d^-2 density distribution of scattering dust in the coma, where d is the radial distance from the nucleus. The flux of the comet decreased as r^-5, where r is the heliocentric distance. This decreasing rate is steeper than that of comet P/Halley.

Photometry of comet Austin 1989c1 in K band. The open squares, circles, triangles, and crosses represents magnitude data of 4200km, 8400km, 12600km, and 16800km apertures at the comet.



Comets, Image Deconvolution, and Second-Generation Instruments

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NO ABSTRACT AVAILABLE